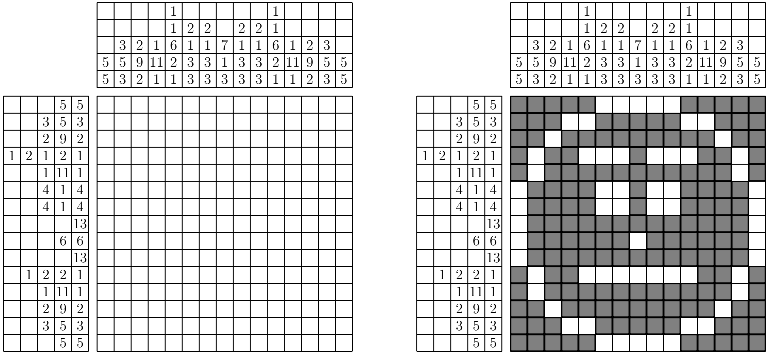
Theory of Computer Games, NTU
Homework #1

Due date: 14:20 (UTC+8), October 26, 2017

Homework Description

- In this homework, you are asked to
    - Implement a solver of **Nonogram**
    - Compare the performance of different search algorithms

Nonogram

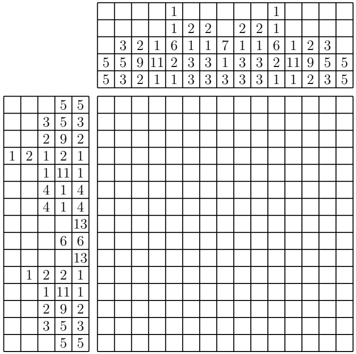


- For each column and row, there is a hint
- For example, 5 5 means
  - There are 2 connected blocks strings
  - Each one has 5 connected blocks

Random Problem Generator

- Random problem generator from TCGA 2016
  - `http://aigames.nctu.edu.tw/~hsuehch/nonogram/tcga2016/boardgen.py`
- Usage:
  - ./boardgen.py n num P1 P2 SEED
  - ./boardgen.py 25 1000 0.5 0.35 12345
    - n: size of board is n by n
    - num: number of test case
    - p1: max probability a cell is black
    - p2: min probability a cell is black
    - SEED: random seed

Input



- Read from standard input.

$1 // Problem Number
5 5 // Hint of first column, from up to down
⋮
5 5 // Hint of last column
5 5 // Hint of first row, from left to right
⋮
5 5 // Hint of last row
$2 // Problem Number
⋮

Output

```
$1
1 1 1 1 1 0 0 0 0 0 1 1 1 1 1
1 1 1 0 0 1 1 1 1 1 0 0 1 1 1
⋮
1 1 1 0 0 1 1 1 1 1 0 0 1 1 1
1 1 1 1 1 0 0 0 0 0 1 1 1 1 1
$2
⋮
```

- Write to standard output.
- For each case, output $(Problem Number) in the first line. Then output *n* lines, each line contains *n* elements separated by space or tab.
  - 1: block
  - 0: non-block
- For example, see output file of boardgen.py.

Standard Test Board

- Your program should at least pass the following test data
    - boardgen.py 5 10 0.5 0.3 514514999
    - boardgen.py 10 10 0.5 0.3 514514999
    - boardgen.py 15 10 0.5 0.3 514514999
    - The time limit is 60 seconds for each input file.
- Notification
    - The input file do not indicate the board size
    - You can caculate it from the number of lines of the input file.

Solution Package

- Submit page: `http://w.csie.org/~tcg/2017/`
- Package structure:
  - Your ID [R05xxxxxx/B02xxxxxx/. . .]
    - code // A folder contains all your codes
    - report.pdf // Your report
- Compress your folder into a "zip" file
- Due to server limitation, the file size is restricted to 2M bytes
- If your program has a pattern database and the size is greater than 2Mb, you can simply upload the code that generates the pattern database.

What Should Be Inclued in Your Reprot?

- About your code
  - You can use any programming language.
  - How to compile and run your program.
  - Must be compiled and run under linux or windows 10.
  - If TA has difficulty in compiling your code, he may ask you to demonstrate the process.
  - What algorithm and heuristic you implement
- Experiment
  - The comparison between different algorithms.
  - Must include running time.
- Discussion
  - The game complexity analysis
  - The factors affect the performance of each algorithm
  - The factors affect the difficulty of Nonogram
  - Other observation or discussion

References

- Nonogram's wikipedia page
  - `https://zh.wikipedia.org/wiki/Nonogram`
- TCGA 2016 Nonogram Tournament
  - `http://aigames.nctu.edu.tw/~hsuehch/nonogram/tcga2016/`
- An on-line nonogram playing site
  - `http://www.puzzle-nonograms.com/`